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ABSTRACT

This paper attempts to place the available information on the nursing shortage in a broader context to improve understanding of some underlying issues. It considers available data on these issues to provide insights into the recurrent nurse shortage for a more rational basis for policy-making. Chapter 1 examines nurses' wages, wage growth, fringe benefits, and labor force participation rates, comparing each of them to similar information on other workers in the United States economy. Using that information, the chapter assesses conflicting interpretations of nurses' wage levels and labor supply behavior. Chapter 2 deals with nurse staffing and vacancies in hospitals; examines the origin and interpretation of data on budgeted vacant positions in hospitals, the most often cited evidence of the nurse shortage; and reviews studies of variations in staffing among hospitals for evidence of effects of shortages on hospital operations. Chapter 3 delves into determinants of the total supply of nurses in terms of factors affecting the annual numbers of entrants to nursing schools. A technical appendix provides information on estimation of starting salaries for registered nurses, regression results of a number of nursing school entrants, and specification error tests. (YLB)

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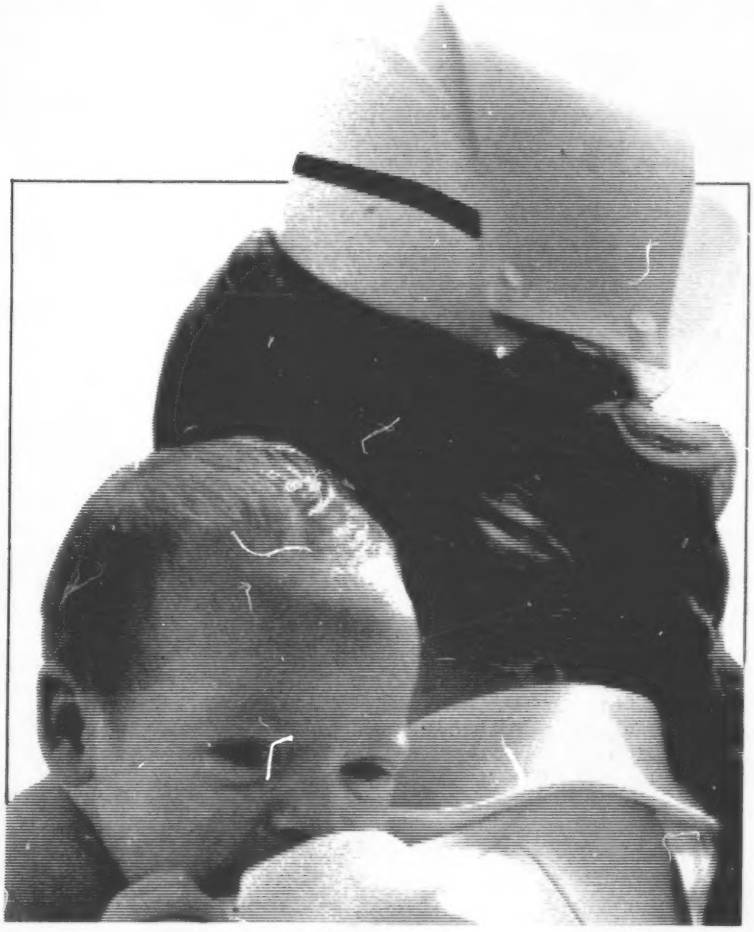
THE RECURRENT SHORTAGE OF REGISTERED NURSES

A New Look at the Issues



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PREFACE

This report brings together available information and data in an attempt to establish an analytical perspective of the current supply of registered nurses. The report was written in the context of a national debate over the existence of a shortage of registered nurses and the appropriateness of alternative national policies to deal with the perceived problems in nursing.

Much of the current debate about the shortage of nurses revolves around the same facts and data. The conflicting views reflect widely contrasting interpretations of the economic conditions in nursing which in turn lead to very different definitions of the policy problem to be addressed. This report attempts to place the facts and data in a broad interpretive context, to provide a framework for improved understanding of many important issues, and to further discussions in the area. In this regard, the Bureau of Health Professions welcomes comments and reactions from readers of the report.

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HIGHLIGHTS

- The wages of nurses have increased more than wages of most workers in the U.S. economy until recently when they began to decline.
- Whatever disincentives exist to discourage nurses from working, the labor force participation of nurses is no lower than that of women employed in similar professional and technical occupations and may be slightly higher.
- The meaning of reported budgeted vacant positions for nurses in hospitals is ambiguous.
- The employment of RNs by hospitals follows the pattern consistent with substitutions among types of nursing personnel based upon market considerations. Results of research on the relation between nursing personnel staffing in hospitals and local availability of nurses are not consistent with the hypothesis that hospitals are constrained in their production of services by chronic shortages of professional nurses.
- Nursing, as an occupation, does not appear to suffer any more or fewer problems than other comparable occupations with a high proportion of female workers.
- The number of entrants to nursing programs is significantly affected by market forces; entrants into nursing programs are positively related to beginning salaries for nurses and negatively related to the wages of alternative occupations.
- The lag between changes in wages, which changes the number of entrants, and the change in nurse graduates causes a cycle or a 'boom and bust' phenomenon which is the root cause of recurring nurse shortages.
- The number of nursing school entrants is related more to the size of the population in the 18-25 year age group than to the numbers of high school graduates.
- The rapid increase in the total nurse supply appears to be due to the increase in wages precipitated by the increase in demand generated by the introduction of Medicare and other programs in the latter part of the 1960s. The decline in relative wages beginning in 1976 resulted in an absolute decline in entrants first witnessed in 1978.
- This decline in entrants and subsequent decline in the rate of growth of the total supply can be expected to continue until the increasing relative scarcity of nurses causes hospitals to raise relative nurse wages once again. When this will happen is speculative; there are some indications that hospitals already have begun to increase wages, (for example, through the recently increased use of relatively expensive temporaries).
- The analyses presented here imply that little can be done either to hasten the market processes that must unfold or to damper the cyclical fluctuations in the nurse labor market.

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INTRODUCTION

A shortage of registered nurses has emerged periodically over the past three decades, most recently in 1979. This shortage persists today. Evidence concerning this shortage was presented before the 96th Congress in hearings regarding the renewal of the Nurse Training Act and again to the 97th Congress as it also considered renewing or modifying the Act.? This paper presents an interpretion of that evidence and explores several causes for the shortage.

The history of the Nurse Training Act dates from 1964, when P.L. 88-581 established the first comprehensive program of Federal support for nursing education. This legislation was enacted in response to the Report of the Surgeon General's Consultant Group on Nursing which was appointed in 1961. President Johnson carried the Consultant Group's warning of a pending shortage of nurses to the Congress in his health message of 1964 and recommended authorization of grants to build and expand schools of nursing and to remove financial barriers for students desiring training for the nursing profession. Subsequent enactments of 1966 (P.L. 89-751), 1968 (P.L. 90-490), and 1971 (P.L. 92-158) added new authorities and expanded the program. President Nixon vetoed and then attempted to impound several appropriations under P.L. 92-158 but was not successful. The enactment in 1975 (P.L. 94-63) failed to receive the support of President Ford who pocket-vetoed the bill following adjournment of the 93rd Congress and vetoed it again early in the 94th Congress on the grounds that support for nursing education was no longer necessary. The 94th Congress overrode the President's veto, however. In 1978, the 95th Congress passed a two-year reauthorization of the Act. That bill was vetoed by President Carter, but the programs were funded in FY 1979 by a continuing resolution. A one-year reauthorization of most nurse training authorities was enacted in 1979 (P.L. 96-76). The 96th Congress then held hearings in 1980 on bills which combined the nurse training authorities with those of the Health Professions Educational Assistance (HPEA) Act; these were reported out of Committee (S.2375 and H.R. 7203) but could not be consolidated and enacted before Congress adjourned.

Between 1960 and 1980 the number of nursing program graduates as well as the number of nurses in the United States grew more rapidly than did the population. Between 1959 and 1969 the annual number of nursing program graduates increased by 45 percent and between 1969 and 1979 by an additional 79 percent. The number of active nurses increased by 42 percent from 1960 to 1970 and by 54 percent from 1970 to 1979. In contrast, the U.S. population grew by only 8 percent from 1970 to 1980.

Despite these increases, many nurse experts continue to insist that a nursing shortage exists. For example, Carolyne K. Davis testified on behalf of the National League for Nursing before Congress in 1980 that "The Nation is entering what may be the biggest nursing shortage ever...The shortage of nurses in many States has hit crisis proportions among hospitals, nursing homes, and home health agencies."[1,2]

At the same hearings, however, representatives of the Carter Administration argued that the Nation's aggregate supply of nurses was and would continue to be adequate and that Federal support for nursing education could be reduced and phased out.

The incongruity between the two views results mainly from a dispute over interpretation of the same basic data. This paper attempts to place the available information on the nursing shortage in a broader context to improve understanding of some of the underlying issues. It examines available data on these issues to provide insights into the recurrent nurse shortage for a more rational basis for policymaking. The questions addressed are:

- Given the large increase in the overall supply of nurses over the past decade, why do the complaints of chronic shortages still persist?
- Why have enrollments in nursing programs started to decline?
- What are the determinants of the number of individuals choosing a nursing career each year, and how has Federal health manpower policy affected the size of the overall nurse supply?
- What are the problems of nurse retention?
- Do nurses' labor force participation rates and transfer to other occupations reflect job dissatisfaction, low pay, and other factors?
- What is the meaning of reported vacancies in hospitals?
- How have hospitals staffed their nursing services in the context of the alleged shortage?

In attempting to answer these questions the paper is divided into three parts. Chapter I examines nurses' wages, wage growth, fringe benefits, and labor force participation rates comparing each of them to similar information on other workers in the U.S. economy. Using that information, the chapter

assesses conflicting interpretations of nurses' wage levels and labor supply behavior.

Chapter II deals with nurse staffing and vacancies in hospitals; examines the origin and interpretation of data on budgeted vacant positions in hospitals, the most often cited evidence of the nurse shortage; and reviews studies of variations in staffing among hospitals for evidence of effects of shortages on hospital operations.

Chapter III delves into the determinants of the total supply of nurses in terms of factors affecting the annual numbers of entrants to nursing schools.

REFERENCES

1. *Health Professions Educational Assistance and Nurse Training Act of 1980.* Hearings Before the Subcommittee on Health and the Environment of the Committee on Interstate and Foreign Commerce, U.S. House of Representatives. U.S. Government Printing Office, Washington, D.C., 1980, p. 231.

2. *Health Professions Education and Distribution Act of 1980.* Hearings Before the Subcommittee on Health and Scientific Research of the Committee on Labor and Human Resources, U.S. Senate. U.S. Government Printing Office, Washington, D.C., 1980, p. 468.

CHAPTER I
NURSE SALARIES, FRINGE BENEFITS, AND LABOR FORCE PARTICIPATION PATTERNS

This chapter reviews data on nurse salaries, fringe benefits, and labor force participation patterns and compares these data with similar data for other occupations. The intention is to discern unusual circumstances that may be either a cause or a consequence of the nurse shortage.

WAGES AND SALARIES

Several types of wage comparisons relevant to the nurse shortage issue can be made. Cross-sectional comparisons among occupations indicate differences in the rates of return to investment in education and training. Such comparisons suggest the relative pecuniary attractiveness of entering alternative fields at any particular point in time. Trend comparisons between wages for nurses and other occupations and the overall rate of economic growth can indicate long-term movements of demand relative to supply which would precipitate short-run market adjustments that might appear as temporary shortages or surpluses. For example, if the demand for nurses was increasing more rapidly than the supply, one would expect nursing wages to increase more than wages in occupations not experiencing such growth in demand relative to supply. Finally, one can examine interoccupational differences in wages within the same employment settings in order to assess the extent to which employers react to "shortages" or "surpluses" in determining how they will employ alternative resources to meet the demand for the goods and services they produce. For instance, higher RN wages relative to Licensed Practical Nurses (LPNs) wages might cause hospital administrators to use more LPNs and fewer RNs.

WAGE GROWTH

Growth in nurses' wages (Table 1) has lagged behind the national per capita personal income (Table 2) over the 1960-78 period, 249.6 percent

Table 1 Representative Annual Salaries for Selected Employees and Occupations, 1960-78 [1]

	Hospital Staff					Public School Teachers			Manufacturing Industries	Professional Technical & Kindred Workers
Year	RN's [a,b]	LPN's	Nursing Aides	Medical Librarians	Medical Social Workers	All Teachers	Elementary[2]	Secondary[3]	Production Workers[4]	All Female Workers (Full and Part Time)[5]
1960	$4,080	$3,125	$2,590	—	—	$4,995	$4,815	$5,275	$4,680	$3,868
1963	4,500	3,355	2,780	—	—	5,730	5,560	6,980	5,200	4,163
1966	5,225	3,770	3,020	—	—	6,485	6,280	6,760	5,824	4,801
1969	7,330	5,150	3,925	7,175	8,940	7,950	7,720	8,210	6,760	6,012
1972	9,540	6,990	5,525	9,510	10,815	9,700	9,400	10,000	8,060	7,208
1975	11,640	8,860	7,155	11,690	13,190	11,700	11,300	12,000	9,880	8,553
1978	14,270	10,880	8,950	14,175	15,310	14,200	13,900	14,600	12,948	10,394
% Increase (1960-78)	249.6%	248.2%	245.6%	184.3%	188.7%	176.7%			176.6%	168.7%
% Increase (1972-78)	49.6%	55.6%	62.0%	49.0%	41.6%	46.6%	47.9%	46.0%	60.6%	44.2%

1 Sources: U.S. Department of Labor, Bureau of Labor Statistics, *Industry Wage Survey Hospitals*. A triennial Survey since 1960. U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, from National Education Association, Washington, D.C., *Estimates of School Statistics*, for selected years. Teachers' salaries are reported as the average annual salary for the academic year.

2 Elementary includes kindergarten teachers.

3 Secondary includes junir high teachers.

4 Statistical Abstract, average salaries for all full- and part-time workers, calculated from weekly earnings.

5 U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-60.

a General duty nurses in non-Federal hospitals.

b Annual salaries calculated by averaging hourly salaries in the SMSAs surveyed by BLS, then multiplying them by 2080 hours in a typical work year.

Table 2 Per Capita Personal Income in the United States, 1960-78

Year	Current Dollars
1960	$2,212
1963	$2,457
1965	$2,966
1969	$3,705
1972	$4,524
1975	$5,879
1978	$7,815
% Increase in Per Capita Income (1960-78)	253.3%
% Increase (1972-78)	72.7%

Source: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, for selected years.

compared to 253.3 percent, and also during the 1972-78 subperiod, 49.6 percent compared to 72.7 percent.

But Table 1 does show also that nurses' wages have grown faster in the 1960-78 period than the wages of comparison groups--teachers, production workers, and female professional, technical, and kindred workers. In 1978, nurses enjoyed a greater annual average earnings level than any of these groups.

In addition, the 249.6 percent gain for registered nurses in the 1960-78 period (Table 1) was greater than the 192.8 percent gain for female full-time wage and salary workers in the same period (3rd column, Table 3) while the nurses' 49.6 percent gain for the 1972-78 subperiod was somewhat behind that group's 56.6 percent gain.

Table 4 shows the percentage increase in nurses wages, during the 1960-78 period. In 1960, teachers and production workers earned more than nurses and female professional, technical, and kindred workers as a group, earned almost as much. In 1978, however, instead of being ahead of nurses in wages, teachers were now earning about the same; production workers had slipped behind, while the average wage of female professional, technical, and kindred workers had fallen even further.

In sum, although the rate of growth in nurses' earnings has lagged slightly behind the rate of growth of the per capita personal income, nurses' overall wage growth has exceeded the average of most employees in the U.S. economy, and their 1978 dollar earnings level was above the average.

With regard to other nursing service personnel in hospitals, Table 4 also indicates RNs' wages showned a slight relative gain over wages for LPNs and Nursing Aids through the 1960s; this trend was reversed at the beginning of the 1970's, and by 1978, RNs' relative earnings had essentially returned to the 1960 level.

Table 5 presents estimated LPN/RN staffing ratios for short-term general and other special hospitals between 1949 and 1978. Two distinct secular trends are seen in these data: the increase in the LPN/RN ratio from 1949 to 1970 and the decline in that ratio since 1970. These trends correspond to the trends in RN wages relative to LPN wages, shown in Table 4. This suggests that a long-term trend for substituting LPNs for RNs due to a relative scarcity of RN's was reversed in the early 1970s as RNs became more plentiful.

Table 3 Representative Annual Earnings of Full-Time Wage and Salary Workers in the U.S., and Full- and Part-Time Female Professional, Technical, and Kindred Workers, Current Dollars, 1960-78 [1]

Year	All Workers	Male	Female	Female Professional Technical & Kindred Workers (Full- and Part-Time)
1960		$4,621	$2,948	$3,868
1966		6,856	3,946	4,801
1969	$6,292	7,384	4,472	6,012
1972	7,488	8,736	5,512	7,208
1975	9,620	11,492	7,124	8,553
1978	11,804	14,144	8,632	10,394
% Increase (1960-78)		206.1%	192.8%	168.7%
% Increase (1972-78)	57.6%	61.9%	56.6%	44.2%

[1] Annual salaries calculated from weekly median earnings.

Sources: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, for selected years.

U.S. Department of Commerce, Bureau of Census, *Reports*, Series P-60.

Table 4 Annual Salaries of Selected Workers as a Percentage of Registered Nurses Salaries, 1960-78 [1]

	Hospital Staff					Public School Teachers			Workers	Professional Technical and Kindred Female
Year	RN's	LPN's	Nursing Aides	Medical Librarians	Social Workers	All Teachers	Elementary	Secondary	Production Workers	(Full and Part Time)
1960	100	76.6	63.4	—	—	122.4	118.0	29.3	114.7	94.8
1963	100	74.6	61.8	—	—	127.3	123.5	132.9	115.5	92.5
1966	100	72.1	57.7	—	—	124.1	120.2	129.4	111.5	91.9
1969	100	70.2	53.5	97.9	122.0	108.4	105.3	112.0	92.2	82.0
1972	100	73.3	57.9	99.7	113.4	101.7	98.5	104.8	84.5	75.5
1975	100	76.1	61.5	100.4	113.3	100.5	97.1	103.1	84.9	73.5
1978	100	76.2	62.7	99.3	107.3	99.5	97.4	102.3	90.7	72.8

Source: Calculated from Table 2.

FRINGE BENEFITS

In comparing economic status between occupations either in cross-section or over time, fringe benefits, representing a substantial portion of the total earnings profile of most American workers, must be considered.

Shift Differentials. In 1975, shift differentials for nurses were paid for work on less desirable shifts in nearly all non-Federal hospitals in the 23 metropolitan Areas (SMSAs) surveyed in the Bureau of Labor Statistics' *Industrial Wage Survey: Hospitals*. These differentials covered a significant portion of the total nursing staff in such hospitals, where an average of 25 percent of the staff was employed on the second shift and nearly 16 percent on the third shift.

The predominant form of differential compensation in 1975 was in uniform cents per hour, ranging from 15 cents to $1 premiums, with most hospitals paying between 25 and 75 cents. Several other forms of differential compensation also existed but applied to a smaller percentage of the work force. One was a uniform percentage addition to base pay for off-hour work, running between 10 and 15 percent. Another premium payment scheme paid uniform dollars per month for off-hour work, usually totaling between $80 and $100. The least used premium pay method paid uniform dollars per week. Nurses under this plan usually received around $25 more per week than those on the day shift. These differentials were approximately the same for both second and third shifts and were similar regardless of whether the hospital was private, or State or local government owned and operated. [1]

In 1960, however, things were quite different. Shift differentials were not as prevalent for work on either second or third shifts. The major change since 1960 has been in the number of nurses covered by differentials and a shift from dollars per week to the more uniform cents per hour compensation in 1975. Wide geographic variation in shift differentials prevailed in 1960. Although nearly 95 percent of the nurses in all non-government hospitals were entitled to shift differentials, about 22 percent of the nurses in both Atlanta and Buffalo received no differential at all. In State and local government hospitals, differentials were paid to only 72 percent of their night employees; in Buffalo and Philadelphia about 93 percent of the nurses on second and third shifts received no differentials.

Differentials were paid to the majority of nurses in all the non-Federal hospitals in 1960 by a uniform dollar per week payment plan. The differentials averaged $5-$10 per week with a range from under $2.50 per week to $20 per week depending on the city and the kind of hospital. [1]

Comparing the prevalence and the amount of shift differentials paid to nurses on late shifts in 1960 and 1975 shows that nearly all nurses received such compensation by 1975 and that it had grown significantly in real terms since 1960. The growth in this fringe benefit is even more graphic when recent levels are compared to those of manufacturing workers whose wages and fringe benefits are generally protected by collective bargaining. In 1976, 88 percent of all manufacturing plants in the U.S. had provisions for second shifts while 78 percent had provisions for third shifts. Nationally, nearly 96 percent of the workers on late shifts

Table 5 Estimated Ratios of Full-Time Equivalent LPL's to RN's Employed in Non-Federal Short-Term General and Other Special Hospitals, 1949-1978

Year	Ratio
1949	.16
1950	.17
1951	.19
1952	.21
1953	.15
1954	.26
1955	.29
1956	.31
1957	.33
1958	.35
1959	.37
1962	.40
1966	.45
1968	.50
1970	.51
1972	.50
1973	.49
1974	.48
1975	.46
1976	.45
1977	.43
1978	.41

Source: D.E. Yett, *Data Source Book for an Analysis of Nurse Supply and Demand*, (National Technical Information Servcie, 1974, PB 238 670): pp. 66-154, Table 5-8 (for year 1949 to 1966).

U.S. Department of Health, Education, and Welfare, Public Health Service, *Survey of Nursing Personnel in Hospital, 1968*, pp. 3, 55, 110.

Survey of Nursing Personnel in Hospital, 1970, unpublished data.

American Hospital Association, *Hospital Statistics, 1970 to 1978* (Chicago, IL).

Note: For the years 1949 to 1970, full-time equivalent RNs were calculated by adding all supervisory nurse, and full time general duty nurses and one-half of the part time general duty nurses.

For the years 1972 to 1978, full-time equivalent supervisory nurses are used.

received a differential. The most common form of compensation was in uniform cents per hour; on second shifts, 10 cents was the most common figure while 14.8 cents was the average. On the third shift 15 cents was the most common premium paid with 18.7 cents the average. Earnings for straight-time workers increased nearly twofold over the 15-year period (1961-76) while average cents-per-hour differentials for second shift workers increased by less than two-thirds. [2]

The next most common form of compensation was a differential paid as a percent of straight time salary. Second shift workers most often received a 5 percent differential, paid as a uniform percent of base pay in 1976; the average was 7.1 percent. Third-shift workers most often received a 10 percent premium, with the average being 9.9 percent over base, straight-time pay. Thus, workers being paid a uniform percentage of base pay remained equally well off from 1961 to 1976, as straight-pay increased over this period; those being paid under the uniform cents-per-hour scheme lost financially. [2]

In comparision with these figures, the *Industry Wage Survey: Hospitals* shows average compensation to RNs for off-hour work in 1975 between 25 and 75 cents more per hour. More recently, a survey of 223 hospitals reported by *RN* magazine in 1980 estimated the average hourly compensation for evening shifts to be 54 cents and for night shifts 66 cents more per hour.[3] These findings show that nurses are compensated for working off hours at a much higher rate than other workers receiving off-hour shift differentials.

Paid holidays. Paid holidays granted to nurses working in non-government hospitals in 1960 ranged from five to nine days depending on geographic region; an average of six to eight days was most common. In State and local government hospitals, the majority of nurses received ten or more days per year. This fringe benefit has remained relatively stable through 1975. [1]

Nurses received approximately the same number of paid holidays as all plant and office workers in metropolitan areas in 1976. Plant workers received an average of 8.9 days while office workers on the average received 9.4 paid holidays per year. The combined average was 9.0 days. These data indicate that other workers maintained no significant advantage in this fringe benefit when compared with nurses. [2]

Paid vacations. In general, vacations are given as a function of years of work. The usual length of vacations given in 1975 in hospitals for continuous years of service was two weeks after one year, three weeks after five years and four weeks after 10 years.

A majority of the nurses in each of these length-of-service categories received the number of weeks vacation indicated. In addition, since 1960, a slight liberalization in benefits has allowed more nurses to receive the indicated vacations, although vacation compensation has remained relatively stable overall. [2]

Like nurses, typical plant and office workers received paid vacations related to length of service. Most office workers received two weeks vacation after one year of service; plant workers usually received one week of paid vacation after the first year of service, compared with the average two-week vaca-

Table 6 Distribution of Registered Nurses According to Age, Employment Status, and the Presence of Children in the Home, September 1977

Employment status and presence of children in the house	Total		Under 25 years		25-29 years		30-34 years		35-39 years		40-44 years	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	1,401,633	100.0	87,329	100.0	225,504	100.0	199,403	100.0	178,247	100.0	159,457	100.0
Employed in nursing	978,234	69.8	81,295	93.1	186,736	82.8	140,988	70.7	125,054	70.2	117,000	73.4
Not employed in nursing	423,400	30.2	6,034	6.9	38,768	17.2	58,416	29.3	53,193	29.8	42,467	26.6
but seeking employment	42,028	3.0	1,310	1.5	6,509	2.9	7,671	3.8	8,617	4.8	4,990	3.1
not seeking but employed elsewhere	56,870	4.1	404	0.5	3,571	1.6	7,918	4.0	8,385	4.7	7,970	5.0
not seeking and not employed	324,000	23.1	4,320	4.9	28,658	12.7	42,826	21.5	36,191	20.3	29,507	18.5
with children less than 6	43,320	3.1	2,566	2.9	20,112	9.0	16,476	8.3	3,208	1.8	454	0.3
with children 6 to 17	120,311	8.6	65	0.1	3,560	1.6	23,948	12.0	31,603	17.7	26,887	16.9
no children	158,173	11.3	1,689	1.9	4,815	2.1	2,401	1.2	1,095	0.6	1,973	1.2
not reported	2,195	0.2	—	—	101	0.0	—	—	285	0.2	194	0.1
Information on employment status and/or reason for nonemployment not available	497	0.0	—	—	29	0.0	—		—	—	—	—

Employment status and presence of children in the house	45-49 years		50-54 years		55-59 years		60-64 years		65 + years		Not reported	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	132,496	100.0	144,265	100.0	104,098	100.0	75,960	100.0	81,180	100.0	13,682	100.0
Employed in nursing	95,036	71.7	103,184	71.5	68,140	65.5	35,557	46.8	15,706	19.3	9,537	69.7
Not employed in nursing	37,460	28.3	41,081	28.5	35,957	34.5	40,403	53.2	65,474	80.7	4,146	30.3
but seeking employment	4,838	3.7	3,747	2.6	1,842	1.8	1,502	2.0	644	0.8	359	2.6
not seeking but employed elsewhere	8,338	6.3	7,411	5.1	6,125	5.9	4,037	5.3	2,360	2.9	351	2.6
not seeking and not employed	24,156	18.2	29,923	20.7	27,931	26.8	34,864	45.9	62,420	76.9	3,204	23.4
with children less than 6	—	—	—	—	—	—	—	—	68	0.1	366	2.7
with children 6 to 17	17,113	12.9	10,969	7.6	4,379	4.2	287	0.4	758	0.9	743	5.4
no children	7,043	5.3	18,933	13.1	23,486	22.6	34,319	45.2	61,223	75.4	1,195	8.7
not reported	—	—	21	0.0	65	0.1	258	0.3	371	0.5	900	6.6
Information on employment status and/or reason for nonemployment not available	127 0.1	—	—	60	0.1	—	—		50	0.1	231	1.7

Source: *1977 National Sample Survey of Registered Nurses*, unpublished data.

tion for nurses. Unlike nurses, most plant and office workers had to work between 10 and 15 years before receiving a three-week paid vacation (and between 20 and 25 years to become eligible for a four-week vacation). For each year of service, the average nurse received as many, and usually more, weeks of paid vacation than was typical for plant and office workers with similar longevity. [2]

Insurance and retirement coverage. Insurance coverage for nurses is the benefit which has grown most dramatically since 1960. In 1960, virtually the only widespread employer-contributing form of insurance available to the nurse was life insurance. By 1975, almost all employers of nurses contributed to nearly ever major form of insurance -- hospitalization, medical, surgical, and major medical. Retirement coverage has also grown significantly since 1960. The number of nurses in non-Federal hospitals covered by both Social Security and private pension plans has increased from 42 percent in 1960, to 53 percent in 1966, to 63 percent in 1969, and to 81.5 percent in 1975. [1]

Insurance and retirement coverage for nurses is roughly equivalent to that for plant and office workers. In 1976, 90 percent of plant and office workers were included in insurance plans with life, hospitalization, surgical, and medical coverage. The benefits provided by this coverage were little different from those received by nurses with respect to type of plan available, amount of employer contribution, and the percentage of the work force

covered. [1] Likewise, retirement pension plans covered similar percentages of plant and office workers as did plans offered to RNs. Some 79 percent of plant workers and 86 percent of office workers had these plans available to them in 1976. [2]

SUMMARY OF WAGES AND BENEFITS

Nurses' wage growth over the period has kept them in the upper half of the wage distribution of wage and salary workers in the U.S. economy and has clearly exceeded that of manufacturing workers whose general economic status is protected by widespread collective bargaining. Both the demand for nurses' services and their employment levels have grown rapidly throughout the period; there is no indication in these general comparisons that their wages or fringe benefits have been artificially constrained.

On the other hand, there are clear suggestions that nurses' relative wage growth has been affected by the rapid increase in the supply of nurses over the past decade. For example, the rate of growth in their wages has fallen behind that of other workers in the economy during the recent 1972-78 period. And, in the hospital setting, employers have evidently reversed the long prevalent trend of substituting LPNs for RNs, a trend that persisted throughout the 1950's and 1960's. In the 1970's hospitals have been increasing their use of RNs relative to LPNs as the supply of RNs increased. This increase in supply, however, is associated with a reduced rate of growth of RN wages, both with respect to other workers in the economy-at-large and to LPNs who are now improving their economic status relative to RNs.

Overall, the data reviewed above indicate no significant disparities between the economic status of nurses and that of other workers in the economy.

Table 7 Runs Patterns in the Michigan Panel Data Married White Women Age 30-44 in 1968

(1 corresponds to work in the year, 0 corresponds to no work)

(1968, 1969, 1970)			Obervations	(1971, 1972, 1973)			Observations
0	0	0	126	0	0	0	133
0	0	1	16	0	0	1	13
0	1	0	4	0	1	0	5
1	0	0	12	1	0	0	16
1	1	0	24	1	1	0	8
0	1	1	20	0	1	1	19
1	0	1	5	1	0	1	8
1	1	1	125	1	1	1	130

Source: Computer tabulation by DHPA

Indeed, nurses appear to have achieved wages and fringe benefits that are at least equal to those of comparable occupations. This is in sharp contrast to the situation in 1960 when nurses' wages and fringe benefits were inferior to those received by other workers in comparable occupations. Economists who have studied these developments in nurses' wages and employment as they have evolved since the beginning of the 1970 decade have concluded that these developments are essentially the manifestations of the basic market forces of supply and demand.

NURSES' LABOR FORCE PARTICIPATION PATTERNS

Statistics on the labor market participation status of nurses are often viewed as suggestive for manpower policy. The latest such statistics are those from the 1977 National Sample Survey of Registered Nurses. Table 6 summarizes information from the 1977 survey on nurses' employment status and the characteristics of nurses not employed in nursing at the time of the survey. One interesting figure as far as policy is concerned is that 23.1 percent of all licensed nurses (324,000) are neither employed nor seeking employment. That such a substantial portion of the total nurse population typically has been inactive at any one time has been cited as evidence both that there is and that there is not a "shortage" of nurses due to wages, working conditions, or other problems. Much of the literature on the nurse shortage over the past two decades has been devoted to discussions of how to attract inactive nurses back into active status.* The question relevant to the shortage issue is whether or not nurses' labor market behavior differs from that

* An extreme example of the implications often imputed to the population of inactive nurses is an article appearing in a recent issue of *RN* magazine. [6] Proclaiming that "here, for the first time, is the story of Nursing's forgotten 400,000," the article labels the currently inactive population of nurses as "dropouts" of whom "92 hold active licenses and could legally return to work -- tomorrow -- if they wanted to." The article reviews the results of a survey of a sample of nurses residing in Florida who were asked various questions about their working conditions and, if they were inactive at the time, why they "dropped out." The thrust of the article is that things are in a "mess" and nurses are being "driven" out of the profession on a wholesale basis. As does most of the body of literature documenting the "mess" in nursing, the article treats nursing in isolation and provides little perspective by which to judge the gravity of the situation. Moreover, one can always find problems with any situation in an absolute sense which would not be judged extraordinary in a comparative context. The appropriate question to ask (even though it is relatively easy to find and uncover complaints and perceived problems among nurses) is, do they, in the aggregate, manifest different labor market behavior patterns than comparable groups?

Table 8 Runs Patterns in the Michigan Panel Data Married White Women Age 45-59 in 1968

(1 corresponds to work in the year, 0 corresponds to no work)

(1968, 1969, 1970)			Obervations	(1971, 1972, 1973)			Observations
0	0	0	87	0	0	0	96
0	0	1	5	0	0	1	5
0	1	0	5	0	1	0	4
1	0	0	4	1	0	0	8
1	1	0	8	1	1	0	5
0	1	1	10	0	1	1	2
1	0	1	1	1	0	1	2
1	1	1	78	1	1	1	76

Source: Computer tabulation by DHPA.

of comparable populations in comparable occupations. Only through interoccupational comparisons of labor force participation patterns can conclusions be drawn about nurses' inactivity rates, turnover rates, and the rates at which nurses leave nursing to enter other occupations.

Nurses' labor supply behavior has been the subject of a number of research efforts over the past 10 years in efforts to isolate and quantify the determinants of nurses' activity rates and hours of work, and to determine the responsiveness of nurses' labor market participation to economic incentives.

Most of this work has been stimulated by previous debates surrounding perceived shortages of nurses and questions about the potential effectiveness of alternative policies for increasing the amount of labor supplied by the Nation's trained nurse force. At the present time, there is probably general agreement among labor researchers that nurses' labor supply is not highly responsive to changes in wages in the short run, and that nurses' labor supply functions may even become "backward bending" at higher wage levels. Recently, longitudinal (panel) data on married women's work histories have become increasingly available for analysis of labor market behavior. A striking feature of panel data on married women's labor market participation patterns is that they show that a high proportion of the observed women work all the time or do not work at all. This feature has been noted by many who have attempted to re-interpret past empirical studies of women's labor supply based on cross section data.

Typically, only a small proportion of women in longitudinal surveys are observed to exhibit fluid labor market participation patterns; the larger proportions of individuals are found in a seemingly "permanent" state of labor market participation or non-participation. This pattern, for example, is vividly evident in the Michigan Panel on Income Dynamics.

Tables 7 and 8 record the distribution of labor market participation patterns of the 530 continuously married white women in the Michigan longitudinal data over the period 1968-1974. A woman is defined to be a market participant if she reported working for money any time during the sample year. The noteworthy feature of the data is that 75 percent of the sample of younger women either work all the time or do not work at all; the corresponding figure for the sample of older women is 80 percent. Both samples are roughly divided evenly between full-time workers and full-time non-workers. In the complete seven year sample, two-thirds of the women either work continuously or do not work at all. There is little evidence of frequent changes in labor market participation status.

The particular studies of nurses' labor supply responses to economic incentives as well as the accumulating longitudinal evidence on women's labor market participation patterns indicate that a substantial portion of the trained nurse force will remain inactive and that its constituents will not be induced into active status through changes in wages or other economic factors. The question remains, however, about whether or not the problems in nursing are manifested in extraordinary inactivity rates or movements of nurses into other occupations.

At the present time, data affording such comparisons are not plentiful. For example, Tables 7 and 8 display labor force participation patterns for married women in the Michigan Panel of Income Dynamics. Unfortunately, the occupational breakdown of the Michigan data is not adequate to make interoccupational comparisons between nurses and other professions. However, there is one new source of data that allows such comparisons: The National Survey of Family Growth (NSFG), which was conducted in 1973-74 and again in 1976 through personal interviews of 9,797 and 8,611 women, respectively, who were less than 45 years of age and who were currently or previously married, or single with natural children. Although the emphasis of the NSFG is on maternal and child health and family planning practices and attitudes, usable information on occupation and work histories was included. The analysis which follows emphasizes comparisons from Cycle II, the most recent of the surveys. [15]

Table 9 presents comparative labor force participation rates of respondents in Cycle II at the time of the survey. Several considerations are involved in choosing comparable occupations to nursing. First, the number of respondents in an occupation must be adequate in order for a comparison to be statistically valid. Occupations having less than 40 representatives in the sample have not been selected for comparison. In this way, erroneous generalizations influenced by large sampling errors can be avoided. Second, the occupations to be compared with nursing should be populated by a large proportion of women, i.e., they should also be regarded as female-dominated occupations as is nursing. From the standpoint of career choice, they should be occupations considered by a majority of women as alternatives in their selection of a profession or career.*

Third, the occupations should have the same professional status as nursing. Thus, comparison has been restricted to occupations within the professional, technical, or kindred category. Finally, the distributions of demographic characteristics that one would expect to influence women's labor market population -- such as age, number of children, husband's income and education -- should be comparable across samples of individuals in the occupational category compared.

Application of those criteria lead to the collection of occupations shown in Table 9. Not surprisingly, the occupations shown are those with which comparisons are typically drawn in discussions of nurses' economic status.

The remarkable feature of Table 9 is the essential uniformity of current labor force participation rates across the specific occupational categories that were compared. For the seven professions, the lowest rate is 60.61 while the highest is less than eight points above that. Also, the participation rates of women in the occupations specifically compared do not differ from the average of all those in the remainder of the occupations in the professional, technical, or kindred category.

Table 10 extends the comparisons of labor force participation to the work histories reported by the same respondents to the NSFG. In contrast to the

* Estimates from the 1970 census indicate that of the total experienced female professional, technical, and kindred labor force 16 years of age and older, 68.5 percent are either teachers or are in the health field (excluding physicians and other practitioners). Those plus accountants, librarians, and social workers account for 77.7 percent; and those plus writers, artists, and entertainers make-up 83 percent of the female professional labor force.

Table 9 Current Labor Force Participation Rates for Women Classified as Professional, Technical or Kindred Workers, NSFG-1976

Profession	Percent Working	Percent Not Working	Number of Respondents Working
Registered Nurses	66.84	33.16	190
Social Workers	68.33	31.67	60
Elementary Teachers	60.61	39.39	198
Kindergarten Teachers	62.79	37.21	43
Secondary Teachers	66.97	33.03	109
Other Teachers	62.50	37.50	112
All Others	62.65	37.45	407
TOTAL	63.72	36.28	1,119

Source: Computer tabulation by DHPA

Table 10 Work History of Women Classified as Professional, Technical and Kindred Workers, NSFG-1976

Profession	Employment patterns [1] 1	2	3	4	5
Registered Nurses	2 (1.27)	8 (5.06)	5 (3.16)	114 (72.15)	29 (18.35)
Social Workers	2 (4.20)	0 (0)	0 (0)	38 (80.85)	7 (14.89)
Elementary Teachers	0 (0)	4 (2.76)	7 (4.82)	114 (78.62)	20 (13.79)
Kindergarten Teachers	2 (5.26)	1 (2.63)	1 (2.63)	29 (76.32)	5 (13.16)
Secondary Teachers	0 (0.0)	4 (4.71)	7 (8.24)	59 (69.41)	15 (17.65)
Other Teachers	0 (0.0)	2 (2.27)	4 (4.55)	74 (84.09)	8 (9.09)
All Other Professions	4 (1.37)	23 (7.79)	5 (1.72)	216 (74.48)	42 (14.48)
TOTAL	10 (1.18)	42 (4.94)	29 (3.41)	644 (75.68)	126 (14.81)

[1] Definitions of work patterns codes:
1-Never worked
2-Worked before marriage but not after.
3-Worked before marriage and after but had a break of more than six months after birth of first child.
4-Worked before and fter marriage but had a break of more than six months after second or later child.
5-Worked continuously with no more than six months between birth of child and rturn to work.

Note: Percentages in Parenthesis.

Source: Computer tabulation by DHPA.

Michigan Panel and other longitudinal surveys in which work histories are accumulated in continuous time, the NSFG work history data are keyed to the birth of children with no reference to calendar dates. Consequently, sequence frequencies cannot be directly compared in the NSFG data as was possible with the type of data available from the Michigan panel presented in Tables 7 and 8. Rather, the analysis is limited to a comparison of market behavior relative to the birth of respondent's children without reference to the timing or duration of employment. Nevertheless, any systematic differences in work behavior due to occupational influences should make themselves apparent in such a comparison.

Table 10 shows the proportions of respondents in each occupation falling into five mutually exclusive categories of work history. While 15 percent of women have worked continuously, spending no more than six months out of the labor force after giving birth, 76 percent are not so systematic in their return to work, at least in terms of the rather arbitrary six-month criteria. However, the specific occupation has no particular effect in the distribution of women within the categories of work patterns.

Table 11 Cumulative Years of Labor Force Participation of Women Classified as Professional, Technical or Kindred Workers, NSFG-1973

Profession	Number of Respondents	Average Age	Average Years Worked	Years Worked at Percent of Time Since Age 21
Registered Nurses	179	33.4	4.41	35.6
Social Workers	48	31.9	3.22	29.5
Elementary Teachers	271	32.4	4.12	36.1
Kindergarten Teachers	38	33.6	3.44	27.3
Secondary Teachers	106	30.7	4.38	45.2
Other Teachers	24	35.0	4.96	35.4
Total Sample	1062	32.41	4.13	36.2

Source: Computer tabulation by DHPA.

Table 12 Percent Distribution by 1970 Status of Women Classified as Professional[1], Technical, or Kindred Workers, 16 years old and older who were employed in 1965, by Occupation in 1965

Occupation in 1965	Status in 1970			
	Employed in Same Occupation	Transferred to Different Occupation	Not in Labor Force	Dead
Registered Nurses	61.82	11.15	22.15	3.82
Librarians	57.01	16.38	20.50	5.15
Social Workers	55.61 [1]	17.76	21.77	3.70
Elementary School Teachers	53.08	17.66	24.14	4.36
Prekinder garten and Kindergarten Teachers	53.14 [1]	18.85	23.32	3.37
Secondary School Teachers	57.34	14.48	23.98	3.44
Other Teachers	56.22 [1]	18.34	18.25	6.18
All	63.97	8.16	22.87	3.87

[1] Standard error less than 10%; all others have a standard error less than 5%.
Source: See reference 13.

Table 11 provides an alternative view of work history data from Cycle I of the NSFG. Data had been collected that allows computing the number of years each respondent worked during her adult life, and Table 11 shows the average years worked by women in each occupation. Since the cumulated time in the labor force is influenced by the age of the respondents, the average ages of the respondents are also reported, as is the average percent of lifetime since age 21 spent working by women in each occupation. This last figure should control for differences in the age distributions of women across occupations. Although there is some variation of cumulated time worked among the occupations, nurses are approximately in the middle of the distribution, perhaps toward the high side.

OCCUPATIONAL MOBILITY

Table 12 reports and compares the occupational mobility of nurses and other female professional, technical, or kindred workers, using data derived from the 1970 Census of Population. [18] Respondents had been asked to report their work status and occupation in 1965 as well as in the census year, 1970.

The results provide information on labor market participation and movements from one occupation to another.

The percent of nurses with unchanged employment status over the five-year period was only slightly less than the average of all women in the professional, technical, or kindred group but higher than all of the comparable occupations chosen within the group for comparison. Similarly, while higher than that for the group as a whole, nurses' rate of transfer to other occupations is uniformly less than that of women in the comparable occupations.

SUMMARY OF LABOR FORCE PARTICIPATION FINDINGS

Data in Tables 9 through 12 were examined to determine if nurses' labor market participation in the several dimensions examined may be different from that of similar populations of women in comparable occupations due to differences in occupation-specific influences. Interoccupational comparisons were made of current labor force participation and return-to-work over the childbearing portion of the life-cycle, of long-term stability of employment behavior, and of rates of transfer to different occupations. In not one instance was nurses' labor market participation different in any essential respect from that of other women in comparable occupations.

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CHAPTER II
THE HOSPITAL SECTOR -- VACANCIES AND STAFFING

The debate over the shortage of nurses centers on the hospital setting. Within that context, the most often cited factor is the chronic prevalance of reported vacant nursing positions. This chapter examines the available facts surrounding these issues and also asks the following question: If there really is a chronic shortage of nurses manifested by perceived work force turmoil and alleged inability to fill vacancies, how have hospitals continued to provide acceptable nursing services? To answer this question, several studies of the determinants of nursing service staffing in hospitals are reviewed.

BUDGETED VACANT POSITIONS

Perhaps the most widely discussed indicator of the nurse shortage and hospital recruitment and retention problems is the "vacant" position. Estimates of nurse shortages measured by vacant positions in hospitals originate from several sources but primarily from surveys conducted periodically at the State or national level by various hospital organizations. This section reviews several of the most recent of these surveys and their findings.

Statistics on budgeted vacancies for registered nurses in hospitals have not been collected nationally since 1971 when the American Nurses' Association (ANA) ended a series of national surveys of hospital vacancies. The first of the series was in 1967, when the ANA surveyed selected large non-Federal, short-term general hospitals and found that the reported vacancy rate differed among hospitals of different sizes. For those hospitals with 200-299 beds, an average rate of 12.1 percent was reported, while for hospitals of a size greater than 300 beds, the rate averaged 14.5 percent. The ANA repeated the study in 1969 and found that the reported vacancy rate had dropped to 6.9 percent and 10.5 percent, respectively, for the two sizes of hospitals.

In 1971, the study was again repeated, with findings showing a decline in the vacancy rates to 4.6 percent and 5.0 percent, approximately one-third of what they had been four years earlier. During those four years, significant salary increases had been granted to RNs. [1]

More recently, separate State studies have been undertaken in New Jersey, California, Maryland, and Texas between 1978 and 1980, and it is on these studies that recent estimates of the nursing shortage have apparently been based.* Each study offers somewhat different results; each is briefly summarized below to acquaint the reader with the study techniques.

Texas Study — "Texas Hospital Association Survey of Nursing Staff Requirements"[3] was based on a survey of all long and short-term hospitals that were Association members. Of 496 short-term hospitals, 421 (84.9 percent) responded as did 32 of the 43 long-term hospitals (74.4 percent). The survey instrument asked for the number of positions currently "budgeted and unfilled" in addition to those filled. Of the 29,448 budgeted positions, 4,129, or 14 percent were reported vacant. The survey was also used to estimate total requirements for nurses over the next 12 months by asking about needs originating from expansion and job reclassification. It was estimated that 9,017 RNs would be needed over the next 12 months to account for deaths and retirements, expansion of facilities, and present unfilled budgeted positions. This represented a need for 26.8 percent more nurses over the 12-month period.

Most of the reported vacancies occurred in the evening or night shifts, 38 and 37 percent, respectively. These shifts were usually straight and did not allow for rotations or combination shifts. The study also found that more vacancies existed in full-time as opposed to part-time positions, and were located predominantly in short-term hospitals.

California Study — "A Study of the Recruitment of Registered Nurses of California Hospitals." [4] In 1977 the Office of Health Professions Development, California Department of Health, in its Health Manpower Plan, acknowledged that some local shortages for other than day shift nurses existed but said that "nurses seeking employment in some areas have experienced considerable difficulty" and concluded that "most indications are that current and future supplies exceed needs and requirements." To guard against an almost certain oversupply in the future, as a result of expanded State training programs, the Department of Health recommended that efforts to increase supply be targeted at "preparing those special skill categories of nurses for which there is a clear need and for those likely to locate for active practice where areas of nursing undersupply may still exist."

The California Hospital Association, dissatisfied with the conclusions and recommendations made by the State, conducted a study among its constituent hospitals in 1978. This study surveyed all members of the California Hospital Association

* A widely quoted estimate that there are 100,000 vacant nursing jobs throughout the Nation is apparently based on a review of local newspaper articles on the subject of the shortage of nurses. The source of this estimate does not describe how the estimate was made or derived.

(CHA); it had a response rate of 61 percent. Results indicated that with an estimated 52,889 nurses currently working, approximately 8,321 budgeted vacancies existed, presenting a 13.6 percent vacancy rate.

The California Study also indicated that, as in Texas, most of the vacancies existed on late shifts. In addition, most of the vacancies persisted in specialty areas such as medical/surgical and intensive care/coronary care units.

Despite California hospitals' concern over budgeted vacant positions, the State of California continued to maintain that the supply of nurses statewide was adequate. It noted that there also continued to be an increase in the supply of nurses in the State and said that the "shortages" indicated by vacant budgeted positions were prevalent in off-hour shifts and specialty areas and due to a lack of qualified personnel rather than too few personnel.

The New Jersey Study — "An Analysis of the Need for Registered Nurses in New OJersey" [5] was conducted in 1980 in response to policy enacted by the Board of Higher Education in 1977, which placed a cap on enrollments in nursing education programs in the state. This policy was based on a previous study conducted in 1976, which projected a small surplus of nurses in 1980 that would continue to grow over the succeeding five years. The recent New Jersey study confirmed the findings of the earlier study with respect to a long-range surplus of RNs but identified a current shortage of RNs principally in acute and long-term care facilities, predominantly during the evening and night shifts, and in specialty areas.

The 1980 survey was in the form of a questionnaire which was sent to 441 hospitals in the State; the results were augmented with a series of open-ended interviews with Chief Executive Officers and Directors of Nursing in nine categorically representative hospitals. In addition, requests were sent to 49 States and the District of Columbia asking each of these jurisdictions to summarize and highlight their particular situations with regard to nurse employment.

The results of the survey indicated that the shortage was not serious. The New Jersey Department of Higher Education concluded that there was a statewide shortage of about 10 percent in short-term hospitals. It was estimated that 61 percent of the licensed nurses were active in the State as compared to a national average of nearly 70 percent. The explanation for the "shortage" in New Jersey was traced to the increase in the number of bachelor's degree nurses now working in the State; it was suggested that they historically work less in hospitals and drop out more often as they grow older. Also, there was a feeling in the State that adequate clinical training was not being given in the educational institutions.

The study pointed out that the "shortage" continues despite the fact that the RN-to-population ratios in New Jersey have risen since 1975, when no shortage was reported, from 527/100,000 population to 589/100,000 population in 1980. The national average is 520/100,000 population. It was concluded that most of the "shortage" in the State comprised local shortages, shortages of nurses with specialized skills, and shortages on late shifts.

To combat the "shortage," 50 percent of the hospitals reported that they have started using nursing personnel pools, are substituting LPNs for RNs, and are increasing their efforts to recruit foreign-trained nurses. Flexible time schedules, tuition reimbursement benefits, and refresher courses are offered by a number of hospitals in an effort to tap the inactive pool.

Maryland Study [6] — This study surveyed 48 hospitals; reported vacancies were correlated to a number of variables. It was estimated that the State had an average vacancy rate of 13.8 percent with general hospitals having an average 13.2 percent vacancy rate and specialty hospitals, 18.7 percent. Smaller hospitals had a greater percentage of vacancies than larger hospitals. Perhaps the major finding from this survey was that the average vacancy rate did not generally fall until salary levels reached the $7.21 - $7.80 level, then began to decrease.

NURSE STAFFING IN HOSPITALS

Despite the numerous complaints of recruiting and retention problems one hears against the background of pervasive reports of chronic vacancies in hospitals, hospitals have managed, by and large, to carry on. Occupancy rates of short-term general hospitals have averaged between 73 and 78 percent throughout the past decade; admissions, census, and employment have continued to expand as the industry's size and rate of economic activity have grown. In the face of such apparently contradictory signs of chronic difficulty on the one hand and continued growth on the other, it is important to determine how the industry managed to

maintain its growth and vitality if there has indeed been a chronic shortage of nurses.

To evaluate the significance and impact of the "nurse shortage" on hospital operations, two alternative hypotheses can be stated. The null hypothesis is that the shortage is not a "real" one. That is, even though there are complaints about not enough nurses being available, in confronting the reality of resource constraints in relation to their preferred staffing patterns, hospitals are able to increase utilization of the more plentiful resources to compensate for resources that are relatively scarce. Nevertheless, vacant positions are announced and recruiting activities are undertaken. The alternative hypothesis is that the range of permissible variation in utilization is very limited, and that failure to recruit and maintain the preferred numbers of nurses cannot be accommodated by increased utilization of other nursing service personnel and other measures. This alternative hypothesis implies that hospitals cannot readily adjust to changes in resource constraints or accommodate to variations in relative supplies of resources. In this case, vacant positions would represent the difference between necessary and actual employment, and rigidities would be observed in staffing despite the occurrence of variations in relative resource availability.

Under the alternative hypothesis, one would observe little variation in relative rates of employment of personnel or variation in staffing across hospitals facing differences in resource constraints or relative resource supplies. With rigid staffing ratios thus required, one would see variations in resource constraints and supplies reflected in variations in output with staffing ratios essentially constant. In contrast, the null hypothesis implies that variable utilization can take place much more freely and that staffing ratios will change with local variations in resource availability, but in a way that does not force reductions in output.

To determine which of the two hypotheses can be rejected, one may review empirical studies of nurse staffing in hospitals. Although a number of descriptive studies of staffing patterns have been published, only a few have analyzed the relation of staffing and variations in staffing to variations in resource availability. One noteworthy study is that of Levine and Phillip, [7] who developed a comprehensive data set from the AHA's 1970 annual survey of hospitals, the 1970 AHA-Division of Nursing survey of nursing personnel employed in hospitals, and several other standard sources of statistics on local sociodemographic conditions. The total sample comprised 3,800 short-term general hospitals stratified into three groups according to ownership and teaching status. Regression models were developed to statistically explain variations in staffing in six personnel categories, measured by staff hours per patient day. Independent variables were included in the regression models to control for differences in case mix, output volume, and availability of advanced technology facilities among hospitals. With these inter-hospital differences controlled for, Levine and Phillip found significant interaction among variables measuring local availability of nurses and nurse staffing. Except in proprietary hospitals, employment of RNs was found to increase with their local availability while the employment of LPNs, aides, and orderlies decreased. Likewise, the employment of LPNs increased with availability of LPNs, while employment of aides and orderlies decreased; this pattern prevailed throughout all strata of hospitals. The availability of ancillary personnel also had a positive impact on their employment throughout all hospital strata while decreasing the employment of RNs and LPNs. In the Levine and Phillip study, the staffing patterns were entirely consistent with the null hypothesis regarding the significance of planning budgets vis-a-vis actual accommodation and adjustment to resource constraints and nursing personnel availability.

In a more recent effort, the Division of Health Professions Analysis (DHPA) has assembled an even more comprehensive data set than that developed by Levine and Phillip, consisting of successive annual observations on 915 short-term community hospitals through the period 1969-1978. Thus, as opposed to the Levine and Phillip cross-section data, the DHPA data are longitudinal and can directly reveal permanent patterns of staffing behavior which could persist through time even as environmental conditions surrounding hospitals change. Preliminary analysis, similar in approach to that of Levine and Phillip, has been reported, [1] and, as in the Levine and Phillip study, shows that hospitals in areas with greater availability of RNs employ more RN hours per adjusted patient-day but fewer LPN and ancillary hours. In addition, the longitudinal analysis was extended to include the effect of wage differences on the relative rates of employment of RNs and LPNs. A very strong propensity to utilize more LPNs and fewer RNs when RNs become relatively more expensive was found to characterize staffing patterns when ratios of RNs to LPNs were examined. Again, the evidence on hospital staffing reported in this study is consistent with the null hypothesis.

SUMMARY

The statistics on vacant nursing positions developed from the surveys reviewed in this chapter indicate that vacancies occur predominantly in hospitals as opposed to physician offices, clinics, teaching facilities, schools, and industry. Reported vacancies within the hospital sector are apparently influenced by a number of factors. Specifically, a higher frequency of reported vacancies occur on evening or night shifts, in the more intensive and demanding specialties (i.e., ICU/CCU units), in rural and inner-city hospitals and in smaller as opposed to larger hospitals where the patient load per RN is typically higher and the ratio of RNs/LPNs is lower. Taken at face value, these statistics suggest that vacancies do not appear to be uniformly distributed across hospitals or geographic regions.

It is not clear, however, that the statistics derived from these surveys can be taken at face value. None of the survey instruments provided definitions of *vacancies* to guide respondents to the surveys, and the basic meaning of "budgeted vacant position" remains unclear. Several of the surveys were initiated by hospital associations after disagreements arose between them and the agencies in their respective States over whether or not nurse supplies were adequate. The American Hospital Association (AHA) is now planning a nationwide sample survey of hospitals in an effort to clarify the meaning of the "budgeted vacant position" to distinguish between budgeted vacant positions and vacant positions for which the hospital is actively recruiting.

In the absence of a direct measure or conclusive indicator of shortage, the question can be examined indirectly by formulating -- and testing against available evidence -- some alternative hypotheses regarding the effect of a postulated nurse shortage on hospital staffing and patient care delivery. A review of the studies of hospital nursing service staffing which have related variations in nurse staffing with variations in resources availability and relative wage rates indicates that hospitals are able to employ wide ranges of combinations of nursing service personnel to accommodate local differences in relative wage rates. Rather than being constrained by the shortage of nurses, hospitals are seen to exhibit a general flexibility in staffing to provide needed nursing services.*

* It is possible that a shortage of nurses could lower the quality of care in hospitals; however, the data analyzed in this study does not include measures of quality.

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CHAPTER III
CAREER CHOICE AND THE SUPPLY OF NURSES

Many observers contend that the current shortage of nurses will persist and worsen if Federal educational support for nursing schools and nursing students is not continued. However, the obvious questions are:

- Why, even in the presence of substantial Federal programs supporting nursing education, have enrollments in professional nursing programs declined recently?
- What factors determine how many students choose to enter the nursing program each year?

These and similar questions have been the subject of our research on the determinants of the supply of yearly entrants to nursing programs. This research will be discussed in order to clarify some of the issues surrounding Federal health professions policy and alleviation of the nurse shortage.

The principal purpose of the research is to develop an economic model to forecast the annual supply of nursing graduates. As part of this work, several alternative theoretical relationships among the annual number of entrants to nursing programs and various economic, demographic, and policy variables were tested.

THE ECONOMICS OF CAREER CHOICE

The research approach employed for the analysis of nurses' career choice is essentially that developed by Dr. Richard Freeman of Harvard University, who has developed econometric models which were the first to successfully explain or predict the flows of individuals into and through college programs generating undergraduate engineers and scientists. His models of the operation of the market for undergraduate engineers explained one of the most vexing features of that market: periods of extreme labor market tightness with rapid salary growth, followed by periods of surplus and flat or declining salaries. While there had been previous research on this subject, [1,2] none had been successful in explaining, theoretically and empirically, the functioning of the market for engineers.

The unique feature of Freeman's work was the recognition that there are long periods of adjustment (lags) in the supply of new engineers, which are a major cause of the instability in the market for engineers and scientists. The functioning of a market with lags will be discussed in detail later in the chapter.

We have adapted Freeman's general techniques to the case of professional nurses because the nursing labor market exhibits many of the characteristics of the market for engineers. There is an observed phenomenon of periods of "shortage" followed by wage growth which is then followed by a period of relative stability before the cycle repeats itself. Also, both engineers and nurses are primarily trained as undergraduates; only a small percentage of all engineers and nurses obtain postgraduate degrees. In fact, in the period Freeman studied (1946-1967), a large percentage of professional engineers had less than four years of college education (in 1960 the figure was about 44 percent). [3]

There are some differences in the model developed for nurses and that used by Freeman to forecast the supply of freshman engineers. The technical details are discussed in the Technical Appendix following this chapter.

According to Freeman, there are two factors which influence career decisions: nonpecuniary aspects -- a person's tastes, preferences, and ability; and pecuniary aspects -- wages and job characteristics. Since a person can usually choose only one occupation, his or her choice will be controlled by wages and job characteristics if tastes and preferences are the same for occupations for which he or she is equally qualified. Even when the tastes and preferences differ, if the wages and job characteristics are divergent enough, they will dominate. Thus, in Freeman's words:

> . . . the economic theory of career choice is based on the interaction of abilities, preferences, and monetary incentives and on the response of marginal suppliers to changes in monetary incentives. The theory does not postulate, as sometimes claimed, a peculiar *homo oeconomicus* whose sole concern in life is money, who always chooses the more remunerative alternative. It asserts only that there exist some persons on the borderline between careers who, all else being the same, respond to economic stimuli. *The vast majority of persons may be unaffected alternatives in wages* (emphasis added), with their career choice primarily determined by preferences and abilities. Even the marginal supplier (of labor) may not weigh money heavily in evaluating alternatives; money need be important only *at the margin*. [3]

Note the last sentence. As applied to nursing, the theory asserts only that *some* individuals are affected at the margin (i.e., in borderline decisions) by wages, *not all individuals*. The empirical research question we addressed is: What proportion of the population considering nursing as a choice

will be affected by wage, and does the amount of Federal support to nursing education have any measurable effect on the number of entrants?

Freeman has developed formal econometric models based on the concepts discussed above to explain career choice. His models were developed in the context of science and engineering to explain the numbers of individuals entering the various fields in those disciplines each year. Recently, Freeman's models have been adopted by the National Science Foundation in its program of forecasting the supplies of scientific and engineering personnel. We have adopted his approach, with appropriate modifications, to explain variations in the annual numbers of entrants into nursing programs.

THE ECONOMIC MODEL OF NURSE SUPPLY

The decision to enter any education or training program is very much an investment decision. The student must give up months of current income, and pay tuition and fees as well, in order to earn a higher income in future years. For instance, the total costs for an undergraduate degree from a private college may well be over $50,000. In order to justify such a large expenditure, the expected future benefits must be very large indeed.

In the specific case of nurse training and education, the student nurse must give up two to four years of income while paying from $500 to $5,000 per year in tuition alone.* However, in the years after receiving the diploma or degree, a nurse earns considerably more than a high school graduate with no additional training. For example, in 1976 the registered nurse's average annual starting salary was $867 per month compared with $587 for the typical 20-24 year-old female worker. [8] The present value of this difference over 30 years of work may be more than $30,000.**

The prospective nurse must also consider the benefits which accrue to other training or education programs. For instance, instead of entering a two-year nursing program, the prospective nurse could go into a two-year business school program, a two-year computer technician program or a two-year course in metalworking.

The economic model of career choice predicts that more potential students will choose nursing over other careers if nursing wages rise relative to wages of high school graduates or relative to wages of other professionals with similar training. On the other hand, if nursing wages decline relative to the wages of high school graduates or relative to wages of other similar professionals, then fewer students will choose to enter nursing programs. The research reported in this chapter was aimed at determining the strength of relative wages and other factors influencing the choice of nursing as a career.

The delay between the time the relative wages of nurses change and additional graduates enter the labor market is called an "adjustment lag." In other words, if a person is deciding on a career path, the relevant wage the person observes is the wage at the particular point in time. If RN wages show a relative increase or decrease, the change will not affect the supply of current graduates, but rather of future graduates. The adjustment lag for registered nurses is further complicated by the three different degree paths, each with a different lag structure. Baccalaureate programs are approximately four years in length; Diploma programs roughly three years and Associate Degree (AD) programs only two years long. But since AD programs make up about 50 percent of the total supply of graduates, the adjustment process in the overall supply of graduate should be relatively rapid.

Another type of delay in the operation of the labor market is the time needed to learn about and adjust to new salary conditions -- "information-decision" lags. In Freeman's words:

> Information-decision lags are complex phenomena whose extent is difficult to determine a priori. It seems reasonable, however, that they will be greater the greater the *random variation* of wages or employment in a market, the greater the *economic resources* committed by a decision, and the greater the *nonprofit* motive of enterprises. In the first case, variability confuses permanent with transitory developments, making it wise to wait for additional facts before reacting to change. In the second case, the dollar value of resources affect the time devoted to search by increasing the payoff to obtaining correct information. Finally, the absence of clear economic signals and goals probably makes nonprofit enterprises slower to respond to market developments than profit-maximizing firms. [3]

The first two reasons for long lags are not very important in nursing. Since the trends in nurse wages

* Georgetown University provided the high figure of $4,970 during the academic year 1980-81.

** The present value of $280 per month for 30 years at a discount rate of 10 percent is $31,906.

do not show tremendous year-to-year variation, the direction of changes in the immediate past is a relatively good indicator of the future direction. The search for wage information is not particularly difficult for an individual since hospitals are widely dispersed and workers in the field are almost ubiquitous. The third point, however, is more germane to nursing. Nonprofit hospitals dominate the hospital market and thus the response of hospitals to changes in the nurse labor market may have long lags. The implications of the slow responses of hospitals to these changes are discussed in the conclusion to this chapter.

Table 1 Admissions to schools offering initial programs in registered nursing by type of program: 1959-1979 [1]

Year	RN programs			
	Baccalaureate [2]	Diploma	Associate degree	Total
Calendar year				
1952	5,402	37,140	. . . [3]	42,542
1953	5,771	36,947	609	43,327
1954	6,083	38,106	741	44,930
1955	6,985	38,884	629	46,498
Academic year [3]				
1955-56	6,887	37,763	559	45,209
1956-57	7,106	37,571	578	45,255
1957-58	6,866	36,402	953	44,221
1958-59	7,275	37,722	1,266	46,263
1959-60	7,555	40,013	1,598	49,166
1960-61	8,700	38,702	2,085	49,487
1961-62	9,044	38,257	2,504	49,805
1962-63	9,597	36,434	3,490	49,521
1963-64	10,270	37,936	4,461	52,667
1964-65	11,835	39,609	6,160	57,604
1965-66	13,159	38,904	8,638	60,701
1966-67	14,070	33,283	11,347	58,700
1967-68	14,891	31,268	14,870	61,389
1968-69	15,983	29,267	18,907	64,157
1969-70	19,048	30,718	25,583	75,349
1970-71	20,413	28,980	29,889	79,282
1971-72	27,357	29,801	36,996	94,154
1972-73	30,478	29,848	44,387	104,713
1973-74	32,672	26,943	48,595	108,210
1974-75	35,192	24,696	50,180	110,068
1975-76	36,656	23,622	53,033	113,311
1976-77	36,947	22,243	54,289	113,479
1977-78	37,664	20,611	53,653	111,928
1978-79	36,087	18,499	54,131	108,717

[1] RN programs include 49 States and the District of Columbia for all years, Puerto Rico beginning 1953, Virgin Islands beginning 1965, Guam beginning 1966, and Alaska beginning 1978.

[2] Includes a few students admitted to initial program leading to a master's degree.

[3] Included with diploma admissions.

[4] Academic year September 1 - August 31 through 1969-70; August 1 - July 31 thereafter.

Source: American Nurses' Association. *Facts About Nursing: A Statistical Summary*. New York, The Association, Annual eds.: 1954, p. 60; 1955-56, p. 80; 1957, p. 70.

DATA

Three distinct features in the data on entrants to nursing programs are the basis of the forecasting model. First, growth in the annual number of entrants has slightly exceeded the growth in the number of female high school graduates over a long period of time. From 1952 to 1976, the total number of nursing program entrants increased 267 percent, from 42,542 to 113,479 (Table 1), compared to a 252 percent increase in the number of female high school graduates, from 627,000 to 1,592,000.

Second, the educational composition of nursing has changed substantially. In 1953, 36,947 of the 43,327 entrants were admitted to Diploma programs; 5,771 to Baccalaureate (BA) programs; and 609 to Associate Degree (AD) programs. The annual number of entrants to Diploma programs remained relatively unchanged from 1952 until the 1965-66 academic year but then began to decline, dropping to 18,499 in the 1978-79 academic year. On the other hand, the number of entrants into AD and BA programs experienced a rapid growth through the entire period. In 1978-79, there were 36,087 entrants into BA programs and 54,131 into AD programs. From 1950 to 1965, the total yearly number of entrants grew about 2.4 percent per year (compounded) and from 1965 to 1979 at about 4.64 percent. The yearly number of entrants into AD programs grew at about 19 percent annually for the 1950-1979 period. However, during a more recent period (1974-75 to 1978-79) the annual growth rate dropped to only 1.9 percent.

Third, there is some reason to believe that the number of entrants may have peaked. The demographic composition of the U.S. population shows the number of births in the U.S. reaching a high-point around 1960. Since a large proportion of the students who enter nursing programs are presumed to have recently completed high school, the declining number of high school age individuals could cause a decline in the number of people choosing nursing as a career. However, a large proportion of entrants into AD programs come from a larger

Figure 1 Ratio of Mean Yearly Starting Salaries of Registered Nurses to Mean Wage of all Professional, Technical, and Kindred Female Workers, 1952-78

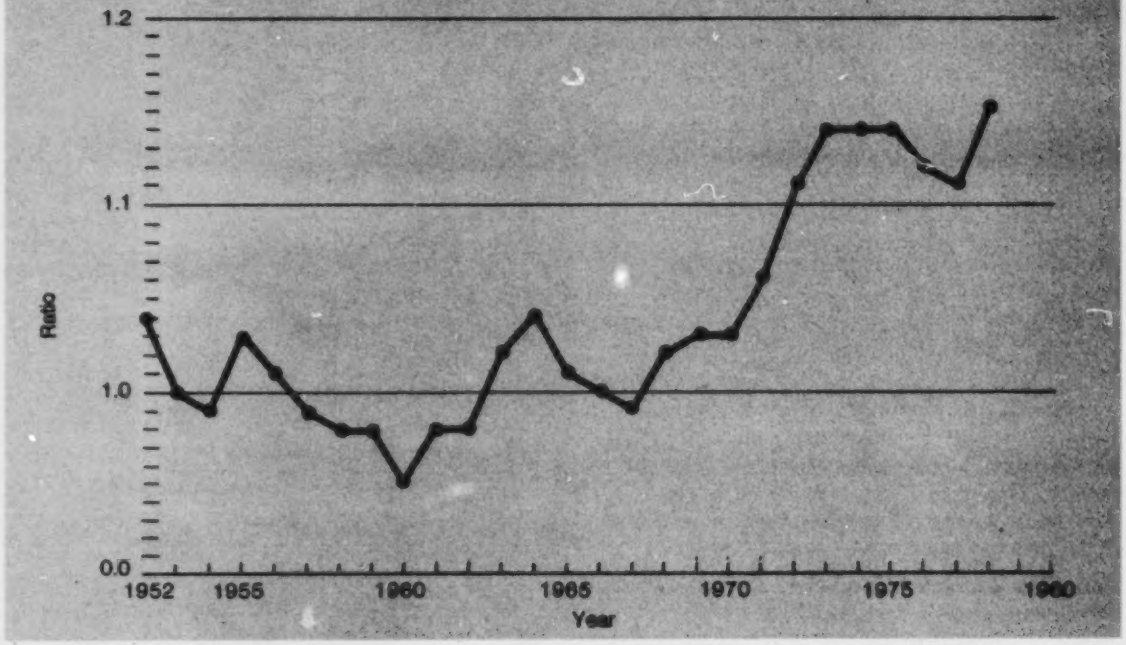
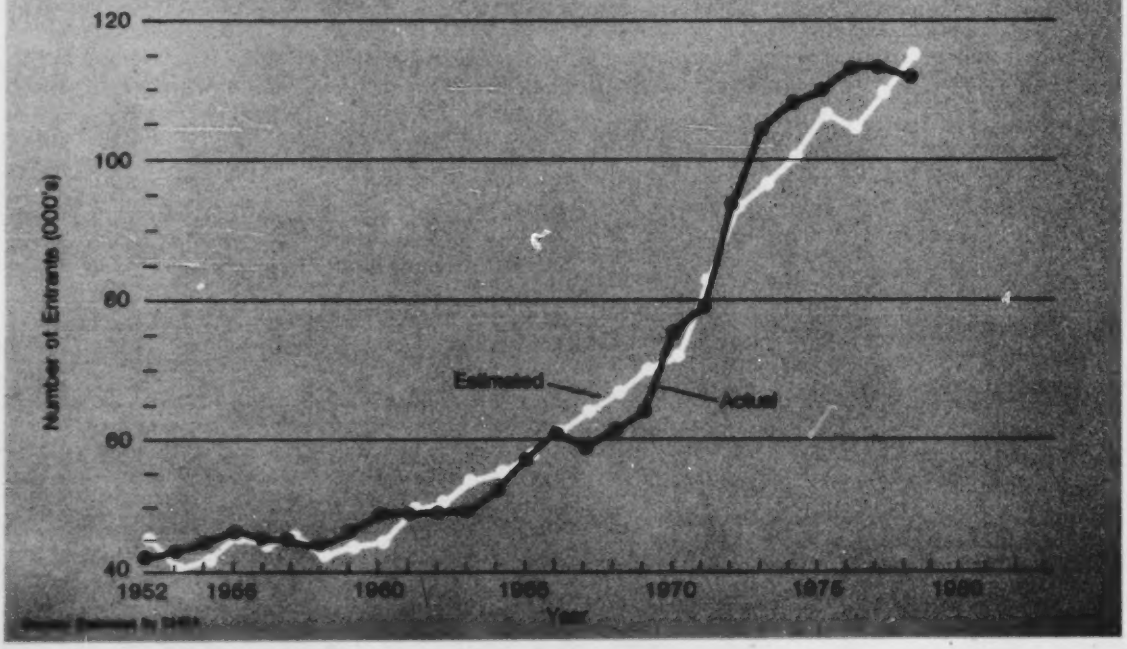


Figure 2 Estimated and Actual Numbers of Entrants to Nursing Schools, 1952-78



population than recent high school graduates; consequently, they may compensate for a portion of the drop in high school graduates.

Time trends in nursing salaries also need to be examined. As shown in Table 2, monthly starting salaries of general duty nurses in non-Federal hospitals increased rapidly from 1966 to 1971. Table 2 also shows how salaries changed after they are adjusted for inflation. Since the period of wage-price controls, there has been a decline in starting salaries when adjusted for inflation.

Figure 1 shows the starting salary of nurses relative to the mean salary of all women in professional, technical, and kindred (PTK) occupations. The wages of nurses relative to wages of all female PTK workers fluctuated between O.96 and 1.04 until 1967 but then began to gain rapidly relative to wages of other PTK women. This increase ended in 1973, probably due to wage and price controls which applied to the hospital industry for an extended period. Then, subsequent to the end of controls in 1976, relative wages of nurses began to decline.

ESTIMATION OF THE MODEL OF THE SUPPLY OF ENTRANTS TO NURSING PROGRAMS

An econometric model of the supply of entrants to nursing programs was developed using the time series data discussed above. The model was estimated with techniques standardized by Freeman's work.* The estimated response in the number of entrants to changes in wages of registered nurses, wages of female PTK workers, and the total female population aged 18 to 25 are shown in Table 3. Both of the wage variables and the population variable were found to have a statistically significant effect on the number of entrants to nursing programs.

Figure 2 demonstrates that the econometric model has tracked the number of entrants to nursing programs quite closely during the 1956-79 period. More importantly, it explains the important long-run movements very well: the almost constant number of entrants in the late 1950's, the steady advance during the 1960's, and the rapid take-off in the early 1970's are all "predicted" by the model. Also, the deceleration of entrants in the late 1970's is anticipated very closely by the model.

The starting salary for nurses in the year that students enter school effects nurses' occupational choice. As Table 3 shows, each 1.0 percent increase in the RN wage rate eventually leads to a 1.5 percent increase in the number of entrants to nursing programs. In dollar terms, this implies that a $9 per month (approximately 30 cents per day) salary in-

Table 2 Mean Monthly Starting Salaries* of General Duty Nurses in the U.S., 1952-1976

(Non-Federal Hospitals)

Year	Starting Salaries	Starting Salaries adjusted for inflation
1952	$233	263
1953	242	277
1954	247	282
1955	253	315
1956	262	322
1957	274	324
1958	286	330
1959	294	345
1960	306	360
1961	323	374
1962	339	384
1963	352	407
1964	378	416
1965	394	410
1966	399	430
1967	430	430
1968	471	452
1969	516	470
1970	561	482
1971	618	509
1972	663	529
1973	709	533
1974	758	513
1975	806	500
1976	867	509

* Note: The monthly starting salary for registered nurses was available for 1952-59 and 1973-76. The 1960-72 period was estimated by assuming that the annual increase in starting salaries for registered nurses between 1959 and 1973 was approximately equal to the annual increase in hospital payroll per FTE employee.

Sources: U.S. Department of Health Education and Welfare, Public Health Service, Division of Nursing, *Data Source Book for an Economic Analysis of Nurse Supply and Demand*, National Technical Information Service, 1974, pp. 369-371.

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* The mathematical form of the model is a logarithmic equation with coefficients estimated by ordinary least squares regression techniques modified to correct for serial correlation. The technical specification of the model is provided in the Appendix to this chapter.

Table 3 Results of the Analysis on Factors Affecting Numbers of Entrants to Nursing Progrms

Factor	Effect on Entrants to RN Programs [1] (Percent Change)
Wage Rate:	
Starting Salary for Registered Nurses	1.58
Average Salary for Professional Women	1.46
High School Graduates	0.5
Female Population aged 18-25	1.0
Federal Programs:	
Appropriations	0.0
Student Assistance	0.0
Capitation	0.0

[1] Percentage change in the number of entrants to nursing programs as a result of a 1.0 change in the explanatory variable (factor).

crease will lead to almost 1,700 entrants per year. A similar increase of 1.0 percent in PTK wages causes an eventual decline of more than 1,600 nursing program entrants annually. These results indicate that a sizable proportion of prospective nurses' choices responds not only to nursing wage but also to wage rates in other professional fields.

Both the number of high school graduates and the number of women aged 18-25 were found to be significant determinants of the number of entrants to nursing schools. The number of women 18-25 was found to be a better predictor than the number of female high school graduates. The model indicates a 1.0 percent increase in the number of women aged 18-25 produces a 1.0 percent increase in entrants to nursing programs, while 1.0 percent increase in the number of female high school graduates produces a 0.55 percent increase in entrants to nursing programs.

Therefore, the decline in the number of enrollees due to a decrease in the 18-25 population group will be slightly less than it would be if high school graduates were the better predictor.

Intuitively, one expects the amount of Federal money appropriated to support nursing education to have a positive effect on the number of entrants to nursing schools. If capitation grants were successful in increasing capcacity, there should be an increase in the number of entrants in subsequent years. Likewise, Federal assistance to nursing students, by lowering the educational costs, should have some positive effect on the aggregate number of entrants. However, while both types of expenditures should produce increases in the number of graduates, the real effect of the programs may be difficult to discern. Since a large percentage of nurses go into AD programs, Diploma programs, or BA programs at State universities, tuition may be an insignificant portion of the cost of attending school, especially when compared to foregone earnings for the period.*

In any case, the amount of Public Health Service (PHS) aid to nursing students may be insignificant relative to the amount of more general higher education support provided by the Federal Government and trivial compared with State support for health professions education. [1] For instance, in 1974, $20,000,000 was appropriated for PHS Nursing Education Opportunity Grants and general scholarships compared to $475,000,000 appropriated for the Office of Education's Basic Education Opportunity Grants. Also, capitation grants were designed to increase enrollment capacity by aiding nursing programs, not nursing students. Since it is not clear that funds given to schools would have an effect on students' decisions to become nurses, little measurable effect of capitation on enrollment may be observable unless capacity was unresponsive to changes in the supply of students in the absence of capitation.

In fact, variables related to PHS nursing student aid and capitation produced no measurable positive effect on the number of entrants to nursing schools that could be found by the statistical procedures employed (See Table 3). These results lead to the conclusion that, controlling for the effects of growth in the population considering nursing as an alternative career, relative wage levels were the major factor attracting individuals into nursing; the effect of wages evidently obscured any measurable effect of PHS funds aimed at increasing the number of entrants. Since the significant increase in demand for nurses and an apparent increase in wages occurred after the passage of Medicare, the increase in the nurse supply has apparently been a "demand-pull" rather than a "supply-push" phenomenon.

* Between 1980 and 1990, the number of women aged 18-25 is projected to decline from 14,459,000 to 12,679,000.

* If a nurse considered her alternative wage to be the minimum wage, at a wage of $3.25 per hour the foregone earnings of going to a community college nursing school for two years would be $13,250, much more than tuition.

IMPLICATIONS FOR THE NURSE SHORTAGE ISSUE

Development of the econometric forecasting model provides some useful insights into the nurse "shortage." If hospitals were to react quickly to a tight labor market for nurses by increasing starting salaries for nurses, the shortage should end within a few years provided wages were increased enough.

However, several factors complicate the situation. First, the market for nurses may not provide the appropriate wage signals to potential nurses because hospitals may not respond to a nurse shortage by immediately increasing wage rates. Hospital administrators might not compete openly and vigorously for the nurses already working by offering higher wages because the total supply of nurses in any particular area cannot be increased instantaneously by higher wages, and any gains for one hospital would necessarily be offset by losses to another. Although such reluctance to compete will not last indefinitely, it will slow the market response necessary to increase wages during a nurse shortage.[4, 5, 7] If the market responds only slowly, adjustments may take many years. Even after starting salaries increase, at least two years will have elapsed before the total number of graduates increases.

The responses of nurse enrollment to salary changes, however, are quite similar to those found by Freeman for engineers. He found that for total freshman college students, engineering salaries and other professional salaries explained 75 percent of the variation in first-year engineering enrollments. The number of graduates were accounted for by lagged freshmen engineering students and lagged engineering salaries. At the margin, engineers, like nurses, based their career decisions upon a comparison between their salaries and those for other professional workers.

Lags in the supply response of nurses to changes in relative wages and the possible long delays in the response of hospitals to changes in labor market conditions lead to periods of tightness in the market for nurses. Even after enough students have decided to enter nursing programs to end a shortage, wages may continue to rise for some time. When graduates begin to come out of nursing programs in larger numbers, the "shortage" will end and starting salaries (adjusted for inflation) will begin to decline. The increases in graduates, however, may continue for several years. The number of entrants to nursing programs will decline almost immediately but the number of graduates will not decline for several years. Thus, the implication of the delayed response of graduates to an increase in wages is for a cyclical relationship between wages and the supply of nurses.

CONCLUSIONS

Analysis of an econometric model of the supply of nurses was presented in this chapter along lines similar to models developed for other professionals which have been characterized by intermittent "shortages."

The analysis concluded that if a tight labor market for nurses leads to a substantial increase in salaries, entrants to nursing programs will increase and the number of graduates will begin to increase significantly after a lag of approximately two years. However, rising wages for women in other PTK occupations will decrease the proportion of individuals choosing nursing among alternative careers.

The model predicts that the 13 percent decline in the number of women aged 18-25 could cause a sharp decline in the number of entrants to nursing schools.

This finding points to the importance of nurse wages relative to wages in other professional occupations as a determinant of the future supply of nurses. If a decrease is expected in the population, then wages will probably be the most important determinant of future increases in the number of entrants to nursing programs.

Finally, the modeling research has not been able to detect any significant effect of PHS programs (i.e., student aid and capitation) aimed at increasing gross numbers of entrants. This does not mean that PHS programs aimed at increasing the quality of nurses or affecting the types of nurses educated have not been successful; the forecasting model reported here did not address those issues. However, the rapid growth of the number of entrants into nursing programs in 1970's appears to have been the result of market forces operating chiefly on the demand for health care rather than direct Federal support for nursing education.

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TECHNICAL APPENDIX

ESTIMATION OF STARTING SALARIES FOR REGISTERED NURSES

The mean monthly starting salary of general duty nurses in the U.S. is available for the periods 1952-1959, [1] 1973-77 [2] and 1979. In order to estimate the 1960-72 period, the annual increase in starting salaries for registered nurses between 1959 and 1973 was assumed to be approximately equal to the annual increase in hospital payroll expense per full-time equivalent (FTE) employee. [3] Column (1) of Table A-1 shows the actual RN monthly salary series with a gap during 1960-72. Column (2) shows the estimated series using the AHA data increases from 294 in 1959 to 667 in 1973 compared with an actual RN wage of 709 in 1973. The rates of estimated to actual increases from 1.0000 in 1959 to 1.0630 in 1973, an annual growth rate of 0.44 percent. Column (3) shows the adjusted RN wage series calculated from the data in Column (2) multiplied by the appropriate ratio between 1.0000 and 1.0630. The monthly starting salary for 1978 was obtained by interpolation from 1977 to 1979 data. This adjusted series was used in all the Chapter II statistical procedures.

REGRESSION RESULTS

In order to assess the effect of individual factors on entrants (admissions) to nursing programs, the following relationship was estimated:

(a) $ADMISS = B_0 + B_1\ RNWG + B_2\ PTKFM + B_3\ POP1825$

where:

ADMISS = Total admissions to nursing programs

RNWG = Monthly starting salary for registered nurses

PTKFM = Average monthly salary for women in profession, technical and kindred (PTK) occupations

POP1825 = Women aged 18-25

All variables are in natural logarithms.

Equation (a) was estimated using a one-stage, modified Cochrane-Orcutt procedure. [4] Table A-2 shows that estimated coefficients have the expected signs and are statistically significant at the 5 percent level. (The coefficients in this logarithm form are equivalent to elasticities.)

The economic model of career choice implies that prospective nurses are interested in the difference between the nurse wage rate and the wage rate for other PTK occupations. Therefore the coefficients on RNWG and PTKFM should be roughly the same

Table A-1 Estimation of Mean Monthly Starting Salaries of General Duty Nurses in the U.S., 1952-1976

(Non-Federal Hospitals)

Year	(1) Actual Wage	(2) Initial Estimate	(3) Adjusted Estimate
1952	233	—	233
1953	242	—	242
1954	247	—	247
1955	253	—	253
1956	262	—	262
1957	274	—	274
1958	286	—	286
1959	294	294	294
1960	—	303	304
1961	—	318	321
1962	—	331	335
1963	—	342	348
1964	—	366	374
1965	—	380	390
1966	—	382	394
1967	—	411	426
1968	—	450	468
1969	—	493	515
1970	—	536	562
1971	—	588	622
1972	—	633	670
1973	709	667	709
1974	758	—	758
1975	806	—	806
1976	867	—	867
1977	931	—	931
1978	1000	—	1000

Sources: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Data Source Book for an Economic Analysis of Nurse Supply and Demand*, National Technical Information Service, 1974, pp. 369-371.

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Table A-2 Regression Results Annual Number of Nursing School Entrants (ADMISS) (N = 27)

Explanatory Variable	Coefficient	t - Statistic
Intercept	-3.782	-1.732
Starting Salary: RN (RNWG)	1.582***	3.119
Starting Salary: PTK (PTKFM)	-1.458***	-3.387
Females aged 18-25 (POP1825)	1.019***	4.033
R^2 = 0.924		
SEE = 0.059		
RHO = 0.482[1]		

[1] Sample first-order autocorrelation from ordinary least squares residuals.

Note: *** Significant at the I percent level.

but of the opposite sign. In fact, the coefficients for RNWG and PTKFM are almost equal (1.582 and -1.458 respectively). The economic model also suggests that a 10 percent increase in the potential nursing student population should increase entrants by 10 percent. The coefficient of 1.019 on POP1825 implies that this is indeed the case.

Table A-3 presents the results from experiments conducted with various explanatory variables. Column 1 shows the effect of using female high school graduates (HSG) as the population variable (instead of females aged 18-25). Since the t-statistic on the population variable (HSG) and the R^2 are smaller and the standard error of the estimate (SEE) is larger than that in Table A-2, we concluded that POP1825 is the appropriate population variable for the nurse model.

Estimates of the effect of various Federal programs are also presented in Table A-3. The estimated coefficients for capitation (CAP), student assistance (STASS), and total appropriation are not statistically significant at the 5 percent level. In fact, two of the three Federal programs are estimated to have a negative impact (although the effect is quite small). Thus Federal programs do not appear to be related to the number of entrants into nursing schools.

SPECIFICATION ERROR TESTS

In order to have confidence in an econometric model, certain conditions have to be met. Specification error tests are diagnostic tools which aid the researcher in identifying specific violations of the usual assumptions required for valid statistical inference. The tests reported in Table A-4 are designed to detect problems associated with higher-order autocorrelation in the residuals, multicollinearity between explanatory variables, errors in functional form and heteroscedasticity in the error term. [5]

The ACCPER test statistic is an accumulated periodogram test for high-order autocorrelaton. [6] It is based on the fact that a plot of the accumulated spectrum for white noise is a straight line through the origin. The ACCPER test has a value which indicates the number of frequencies at which the accumulated periodograms is outside the 5 percent

Table A-3 Annual Number of Nursing School Entrants-(ADMISS) (Time Series Regressions)

Explanatory Variable	1	2	3	4
RNWG	2.984 **	I.645 **	I.877 **	I.848 **
	(6.628)	(3.I62)	(3.678)	(3.592)
PTKFM	-2.9I9**	-I.495**	-I.683	-I.667 **
	(-5.785)	(-3.39I)	(-0.4I9)	(-3.936)
POP1825	--	0.905 **	I.II9 **	I.II7 **
	--	(3.268)	(4.II8)	(4.038)
HSG	0.55I	--	--	--
	(2.030)	--	--	
CAP	--	0.0005	--	
--	--	(-0.893)	--	--
STASS	--	--	-0.0II	--
	--	--	(-I.526)	--
APR	--	--	--	-0.0I0
--	--	--	--	(I.333)
Constant	I3.955**	4.833*	2.986	3.032
	(6.848)	(2.II3)	(I.I62)	(I.I63)
R^2	0.922	0.934	0.947	0.944
SEE	0.075	0.06I	0.062	0.062
RHO [1]	0.27I	0.433	0.349	0.367

[1] Samplefirst order autocorrelation from ordinary least squares residuals.

Note: t-statistics in parentheses
* significant at the 5% level
**significant at the 1% level

Table A-4 Specification Error Tests

Test	Statistic	Status
Accumulated Periodgram [1] Test (ACCPER)	0	pass
Orthogonality Test (ORTHO)	3.3×10^{-12}	fail[2]
Regression Specification [4] Error Test (RESET)	6.757	fail[2]
Bartlett Specification [4] Error Test (BAMSET)	1.328	pass

[1] Any statistic 10^{-5} or smaller indicates extreme multicollinearity.

[2] Rejects the null hypothesis at the 1 percent level of significance.

[4] See Ramsey (1969).

Table A-5 Split-Sample Regression Results

Explanatory Variable	(1)	(2)
Intercept	4.039*	10.415
	(2.868)	(1.251)
Starting Salary: RN	0.172	3.267***
(RNWG)	(0.528)	(3.235)
Starting Salary: PTK	0.101	-2.680**
(PTKFM)	(0.277)	(-2.923)
Females Aged 18-25	0.486 **	1.229
(POP1825)	(2.782)	(2.151)
R^2	0.867	0.965
SEE	0.028	0.061
RHO [1]	0.333	0.054
Sample Period	1952-1966	1967-1978

[1] Sample first-order autocorrelation from ordinary least squares residuals.

NOTE: * significant at 10 percent level
** significant at 5 percent level
*** significant at 1 percent level

confidence interval for white noise. The zero value in Table A-4 indicates that the residuals from the model do not exhibit evidence of autocorrelation higher than the first-order (for which the Cochrane-Orcutt procedure has corrected).

The ORTHO index statistic is a measure of dependence or multicollinearity between explanatory variables. Its value of 3.3×10^{-12} indicates a high degree of dependence. Although multicollinearity does not bias the estimated coefficients of a model, it does lead to the unpleasant characteristic that small changes in the number of explanatory variables or observations can cause large variations in the value of the coefficient for a particular explanatory variable. Table A-3 indicates that minor changes in the set of explanatory variables do not appear to cause large shifts in the coefficients. As another check against instability, the sample was split and separate coefficients were estimated for the two periods 1952-1965 and 1966-1978. Table A-5 shows that the model does not describe the earlier period (Column 1) as well as it does the later period. This result is due partially to the fact that the explanatory variables showed little variation in the earlier period. The split regression shows no instability in the parameter estimates.

The RESET test statistic in Table A-4 is a test for errors in functional form. It has an F distribution with 3 and 20 degrees of freedom which indicates that the value of 6.757 is significant at the 1 percent confidence level. This test is most useful when one wishes to test alternative models; it is unclear what steps should be taken when there is no theoretical reason to change the model's functional form or add more variables.

The final test statistic in Table A-4 is the BAMSET test for heteroscedasticity which is distributed as a chi-square with two degrees of freedom. The BAMSET test value of 1.328 is not statistically significant at conventional levels.

The battery of specification error tests suggests that multicollinearity in the explanatory variables is the most serious problem in the nursing model. Although additional tests did not indicate the instability in the estimated coefficients which is usually characteristic of multicollinearity, the dependence among explanatory variables invalidated the RESET test for errors in functional forms. Other common problems of econo metric models such as higher-order correlation and heteroscedasticity were not detected by the specification error tests.

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